AMENDMENTS TO THE CLAIMS

This listing of claims will replace all prior versions, and listing, of claims in the application:

Listing of claims:

In the Claims

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1. (CURRENTLY AMENDED) A method for forming an amorphous shallow implant region that getters defects from a pocket implantation; comprising:

a) providing a gate structure, on a substrate comprised with a first conductivity type dopant; said substrate comprised of an upper crystalline section;

b) performing a pocket amorphizing implantation procedure to implant ions of a ~~second~~ first conductivity type to form a pocket implant region adjacent to said gate structure, and an amorphous pocket region;

(1) said amorphous pocket region is formed at a first depth below the substrate surface;

c) performing a shallow amorphizing implant to form an amorphous shallow implant region;

(1) said amorphous shallow implant region being formed at a second depth above said amorphous pocket region;

d) performing an anneal procedure to recrystalize the amorphous shallow implant region and said amorphous pocket region, whereby said amorphous shallow implant region reduces defects formed by the pocket amorphizing implant.

2. (ORIGINAL) The method of claim 1 wherein the anneal procedure is comprised of a first soak step and a second spike step.

3.(ORIGINAL) The method of claim 1 wherein said amorphous pocket region is formed at a depth between 40 and 100 nm; said amorphous pocket region has a thickness between 10 and 20 nm;
and the substrate above the amorphous pocket region remains crystalline.

4.(ORIGINAL) The method of claim 1 wherein the pocket amorphizing implantation comprises implanting Sb or In species at an energy between 115 and 150 keV using a quad implant at a 45 degree angle to form a pocket implant to a depth between 40 and 100 nm.

5.(CURRENTLY AMENDED) The method of claim 1 wherein the shallow amorphizing implant comprises: implanting As, Si , or Ge ~~or N~~ species at a dose between 5E13cm^{-2} and 7E14 cm^{-2} and at an energy between 5 and 10 keV, and ~~preferably~~ at a 7 degree and a quad twist; said first conductivity type is N-type and said second conductivity type is p-type.

6.(ORIGINAL) The method of claim 1 wherein said amorphous shallow implant region is formed at a minimum depth of about 8 nm and a maximum depth of 20 nm below the substrate surface; said amorphous shallow implant region has a thickness between 5 and 10 nm.

7.(ORIGINAL) The method of claim 1 wherein the anneal procedure comprises: (1) a soak step at a temperature between 600 and 800 °C for a time between 10 and 30 seconds and (2) a spike step where the temperature ramps up to a peak temperature between 1000 and 1100 °C and a ramp down from said peak temperature to a temperature below 800 °C; said ramp up and ramp down have a rate between 200 and 300 degree °C per minute.

8. (CURRENTLY AMENDED) A method for forming an amorphous shallow implant region that getters defects from a pocket implantation; comprising:

a) providing a gate structure, on a substrate comprised with a first conductivity type dopant; said substrate comprised of an upper crystalline section;

b) performing a pocket amorphizing implantation procedure to implant ions of a ~~second~~ first conductivity type to form a pocket implant region adjacent to said gate structure, and an amorphous pocket region;

(1) said amorphous pocket region is formed at a first depth below the substrate surface;

c) performing a shallow amorphizing implant to form an amorphous shallow implant region; the shallow amorphizing implant comprises: implanting ions of Si, As, or Ge species;

(1) said amorphous shallow implant region being formed at a second depth above said amorphous pocket region;

d) performing a SDE implant to form SDE regions of a second conductivity type using said gate structure as a mask;

e) performing a source/drain implant procedure to form deep source/drain regions;

f) performing an anneal procedure to recrystalize the amorphous shallow implant region and said amorphous pocket region, whereby said amorphous shallow implant region reduces defects formed by the pocket amorphizing implant.

9.(ORIGINAL) The method of claim 8 wherein the anneal procedure is comprised of a first soak step and a second spike step.

10. (ORIGINAL) The method of claim 8 wherein said amorphous pocket region is formed at a depth between 40 and 100 nm; said amorphous pocket region has a thickness between 10 and 20 nm;
and the substrate above the amorphous pocket region remains crystalline.

11. (ORIGINAL) The method of claim 8 wherein the pocket amorphizing implantation comprises implanting Sb or In species at an energy between 115 and 150 keV using a quad implant at a 45 degree angle to form a pocket implant to a depth between 40 and 100 nm.

12.(CURRENTLY AMENDED) The method of claim 8 wherein the shallow amorphizing implant comprises: implanting As, Si , or Ge ~~or N~~ species at a dose between 5E13cm^{-2} and 7E14 cm^{-2} and at an energy between 5 and 10 keV, and ~~preferably~~ at a 7 degree and a quad twist.

13. (ORIGINAL) The method of claim 8 wherein said amorphous shallow implant region is formed at a minimum depth of about 8 nm and a maximum depth of 20 nm below the substrate surface; said amorphous shallow implant region has a thickness between 5 and 10 nm.

14. (ORIGINAL) The method of claim 8 wherein said amorphous shallow implant region has a thickness between 5 and 10 nm.

15.(ORIGINAL) The method of claim 8 wherein the S/D implant procedure comprises: implanting As ions at a dose of between 5E13 and 7E14 atoms/sq-cm; an energy between 5 and 10 keV and a maximum depth between 30 and 50 nm.

16. (ORIGINAL) The method of claim 8 wherein the anneal procedure comprises: (1) a soak step at a temperature between 600 and 800 °C for a time between 10 and 30 seconds and (2) a spike step where the temperature ramps up to a peak temperature between 1000 and 1100 °C and a ramp down from said peak temperature to a temperature below 800 °C; said ramp up and ramp down have a rate between 200 and 300 degree °C per minute.

17. (Currently Amended) A method ~~of~~ for a pocket implant comprising:

a) providing a gate structure on a semiconductor substrate comprised with a first conductivity type dopant;

b) performing a pocket amorphizing implantation procedure to implant ions of a first conductivity type to form a pocket implant region adjacent to said gate structure, an amorphous pocket region and pocket interstitials under the amorphous pocket region;

c) performing a shallow amorphizing implant to form an amorphous shallow implant region and shallow implant interstitials; the amorphous shallow implant region being formed at a second depth above said amorphous pocket region;

the substrate above the amorphous shallow implant region remains crystalline;

(1) said amorphous shallow implant region is formed at a minimum depth of about 8 nm and a maximum depth of 20 nm below the substrate surface; said amorphous shallow implant region has a thickness between 5 and 10 nm;

d) performing a SDE implant to form SDE regions of a second conductivity type, in an area of said semiconductor substrate not covered by said gate structure, with said SDE regions located in a top portion of said pocket region;

e) forming spacers on the sidewalls of the gate structure;

f) performing a S/D implant procedure to form Deep S/D regions;

g) performing an anneal procedure comprised of a first soak step and a second spike step to recrystalilze the amorphous shallow implant region and said amorphous pocket region; whereby said shallow amorphous implant region reduces the defects from the pocket implantation;

(1) the anneal procedure comprises (1) a soak step at a temperature between 600 and 800 °C for a time between 10 and 30 seconds and (2) a spike step where the temperature ramps up to a peak temperature between 1000 and 1100 °C and a ramp down from said peak temperature to a temperature below 800 °C; said ramp up and ramp down have a rate between 200 and 300 degree° C per minute.

18. (ORIGINAL) The method of claim 17 wherein the pocket amorphizing implantation comprises implanting Sb or In species at an Energy between 115-150 keV using a quad implant at a 45 degree angle to form a pocket implant region to a depth between 40 and 100 nm.

19. (ORIGINAL) The method of claim 17 wherein said amorphous pocket region is formed at a depth range between 40 and 100 nm; said amorphous pocket region has a thickness between 10 and 20 nm; the substrate above the amorphous pocket region remains crystalline.

20. (Currently Amended) The method of claim 17 wherein the shallow amorphizing implant comprises: implanting As, Si, or Ge species at a dose greater than 5E13cm^{-2} and at an energy between 5 and 10 keV, and ~~preferably~~ at a 7 degree and a quad twist.

21. (New) The method of claim 1 wherein said amorphous shallow implant region is not a halo region.

22. (NEW) The method of claim 1 wherein said wherein the shallow amorphizing implant comprises: implanting As, Si, or Ge species; said first conductivity type is p-type and said second conductivity type is n-type.

23. (NEW) The method of claim 1 wherein said wherein the shallow amorphizing implant comprises: implanting Si , or Ge species.

24. (NEW) The method of claim 17 wherein said wherein the shallow amorphizing implant comprises: implanting Si , Ge or As species.